# Behavior observation of Amur tiger (*Panthera tigris altaica*) in captivity

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**Abstract** The various behaviors of four Amur tigers in captivity were investigated in March from 1998 to 2001 in Harbin Zoo. The results showed that the behaviors could be divided into 5 major types: moving, resting, sleeping, eating and other behaviors (including drinking, urinating, grooming, playing, standing). Of all behavioral models, sleeping and moving behaviors alone accounted for 75.18% and were two major behavioral models of all behaviors. Resting, eating and other behaviors accounted for 24.82%. Apart from eating, one male and two female individuals have similar peak periods of 4 major behaviors (one peak period in the daytime, and one peak period at night), similar to that of wild Amur tiger. However, one female individual have two clear peak periods at night.

**Keyword**: Amur tiger; In captivity; Behavior; Individual
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## Introduction

Amur tiger (*Panthera tigris altaica*) is an endangered carnivore, and its body is the biggest of all tiger subspecies. In the world, Amur tiger mainly distributed in the far eastern region of Russia, northeastern region of China, and northern region of Korea (Ma 1983).

In China, the number of this subspecies has declined in recent years, and due to increasingly enlarging forest industry production and population explosion and making its habitats worse and worse. Thus it is listed in category Ⅰ of National Protected Animal in China and one of the 10 species of endangered species in the world. Past researches in this area mainly consisted of species inventory (e.g. Ma *et al.* 1998; Yu *et al.* 2000; Li *et al.* 2001), description of ecological habits (e.g. Schaller 1967; Ma 1986), feeding and breeding (e.g. Veselovsky 1970; Song *et al.* 1981; Smirnov 1986; Zhao *et al.* 1991), diseases (e.g. Liu *et al.* 1999) and so on (Teng *et al.*, 1999). So far, previous behavioral studies indicated that Amur tiger got into the habit of being particular with food in captivity, and gradually lost some habits of wild individuals (Shen 1989). Moreover some researchers described the detailed courses of breeding in captivity (Zhao *et al.* 1992; Liu *et al.* 2000), and some experts studied the activity rhythm and home range of radio-collared tigress (Miquelle *et al.* 1993). Understanding fundamental behavioral patterns can be of help in designing appropriate conservation strategies. We observed three female and one male Amur tiger living in Harbin Zoo from March 1998 to March 2001. These data could help us understanding how Amur tiger behaves it to adapt to artificial environment, and supplied some fundamental data to conservation, utilization and restoration of this valuable and endangered species.

## Materials and methods

This study was conducted in Harbin Zoo (126°03′ E, 45°46′ N) from March 1998 to March 2001. The summer of Harbin is short and hot, and winter is long and cold. Annual mean temperature is 3℃, and average precipitation is 400-500 mm. The pens for Amur tiger were situated in the northeastern corner of Harbin Zoo, far away from those of other animals. The interior of cage was composed of cement ground, and a piece of board was laid up. The size of internal cage was approximately 40.6 $m^2$, and external cage 41.6 $m^2$.

From 1998 to 2001, three female and one male Amur tigers were observed in Harbin Zoo. Among them, one male was born in Harbin Zoo in 1987, recorded by M1; one female was introduced from Russia in 1993, recorded by F1; the other two females were introduced from Ningbo Zoo (born in 1985) and Jilin Jiangnan Zoo (born in 1992) respectively in 1998, recorded by F2 and F3. Four individuals were penned separately in cages.

We experimentally quantified the behavioral models of Amur tiger. Behaviors of Amur tiger were recorded in moving, resting, sleeping, eating, drinking, urinating, grooming, playing, and standing. During the experimental observation, individual behavior was determined by all-occurrence recording method, that is to say, whatever we saw Amur tiger do, we recoded the whole course in detail. During the whole observation period, some specific behaviors were also

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determined by focal animal sampling method. We can record the onset and duration of each kind of behavior. Also, we can record the mutual relationship between observed individual and the others.

## Results and discussion

### Average time budget tiger five behaviors

Of five behaviors, sleeping was a kind of major behavior in the whole day. Four individuals all spent more time sleeping than other behaviors (Table 1). The secondary behavioral models were moving and resting, and eating and others accounted for a bit of portion. There were significant differences in moving behavior among 4 individuals ($F=3.54$, $P<0.05$), but there were no differences in sleeping ($F=0.78$, $P>0.05$), resting ($F=1.79$, $P>0.05$), eating ($F=0.39$, $P>0.05$), and others ($F=1.21$, $P>0.05$).

**Table 1. Average time budget of five behaviors of Amur tiger**

| Category | Behaviors /% | | | | |
|---|---|---|---|---|---|
| | Sleeping | Resting | Moving | Eating | Others |
| M1 | 47.28±9.27 | 18.71±10.55 | 27.14±6.33 | 2.75±2.90 | 4.12±3.98 |
| F1 | 55.43±0.66 | 17.14±4.38 | 22.57±2.12 | 1.91±1.01 | 2.95±0.17 |
| F2 | 49.85±3.52 | 24.67±0.21 | 20.44±3.92 | 3.16±0.69 | 1.88±0.77 |
| F3 | 59.39±4.23 | 27.68±4.97 | 8.13±1.29 | 1.26±0.77 | 2.97±1.56 |
| F | 0.78 | 1.79 | 3.54* | 0.39 | 1.21 |

* $p<0.05$

This phenomenon probably resulted from the differences of age, health, physiological periods, abilities adapting to surroundings, and so on. The age has the differences among four individuals, thus behavioral models of them changed accordingly. F1 was trained in the circus troupe of Harbin Zoo, and can keep a friendly relation with visitor, in particular keepers. When keepers and some visitors came near the cage or disturbed F1 occasionally, it excitedly walked in the cage accompanying some onlookers. F3 was introduced from Jinlin Province in 1998. It was unhealthy, unfit to environment, sensitive to visitors, and other voices. Thus it spent less time in moving than other behaviors. Also, when M1, F1 and F2 were active in the afternoon everyday, F3 still were sleeping. These all resulted in the significant differences between its behavior and those of other individuals.

### Activity rhythms of Aumr tiger

Of 4 Aumr tiger, M1, F1 and F3 individuals had similar peak periods in sleeping (one peak period in the daytime, one peak period at night). The onset and duration of peak period were also alike (from 10:00 to 15:00 and from 20:00 to 7:00 next day). Whereas F2 individual had different peak period from the other individuals in sleeping (two peak periods at night). Similarly, resting and moving had similar rhythm. Eating had only one peak period (16:00-18:00).

The movement of wild Amur tiger usually occurred at night, especially in the early morning and dusk (Ma 1986). Later, Miquelle *et al.* (1993) found that mature Amur tiger were most active from 16:00 and 23:00. Also, there was a less pronounced peak of activity between 05:00 and 07:00. This indicated that Amur tiger in captivity possibly retained some habits in nature. In the meanwhile, Amur tiger gradually got into the habits different from that of wild population. F2 and F3 were both introduced from other Zoos, thus they were not adaptive to Harbin Zoo at first. Later, F3 was gradually accustomed to circumstance here. But great changes took place in behavioral model of F2: it spent most of time sleeping in one day, and often bitted the wire netting of its cage or walked at the edge of cage at night. Above reasons resulted in injuries of F2 foreleg. Due to injuries, F2 greatly reduced moving behavior, and increased the behaviors of resting and sleeping.

### Description of various behaviors

*Sleeping behavior*

Sleeping is a kind of major behavioral model of Amur tiger in captive. In a day, it spent more time sleeping than other behaviors. When it felt tired, it may generally return to the board in the cage and lie down. When it got to sleep, it often remained relaxed and made its eyes closed. The postures of sleeping had three types. One was lying with its four limbs under its body, one is lying with its four limbs stretching out, and the other was lying with its back on the ground and its four limbs extending into sky. When sleeping, it sometimes lifted its head or walked in the ground or changed sleeping posture, and then it continues to sleep.

*Moving behavior*

In captivity, Amur tiger often walked along a regular route in the cage. Whether in the day or at night, it walked along the edge of cage inflexibly. It walked more in fine days than in cloudy and raining days. Also, when it was cold, Amur tiger usually ran along the edge of cage. This maybe increases the resistance to the bad days. In the course of walking, it may stand for a short time. When the duration of standing was less than 2 seconds, we still recorded this behavior as moving behavior. When some visitors disturbed Amur tiger, it often ran along the cage.

*Resting behavior*

Resting is a kind of major relaxation model. Amur tiger often spent a plenty of time resting. In contrast to sleeping, Amur tiger's eyes were not closed when resting. The postures of resting had four types. First was bedding with four limbs under its body. Second was bedding with four limbs around the body. Third was bedding with forelegs under the body. Last was bedding with hind legs under the body. When resting, Amur tiger sometimes watched the surrounding, or stood and walked for a while, and then continued to bed.

*Eating behavior*

The food of Amur tiger is mostly living animal, and Amur tiger don't eat dead or rotten animals at all. Amur tiger mostly prey on wild boars (*Sus Scrofa*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), Siberian musk deer (*Moschus moschiferus*), and other hoofed animals. The model of prey is sneaking for several miles, then attacking and biting the neck of animals to make them inescapable. In the wild, Amur tiger can eat 30 kg meat once. However, feeding model is based on regular time and regular site in the Zoo. Usually, animal keepers fed meat at 16:00 in the afternoon. Thus, the peak periods of eating behavior were found from 16:00 to 18:00. The food of experimental animal is as following (Table 2).

**Table 2. Prescription of Amur tiger food**

| | Mutton /kg | Beef /kg | Eggs | Powdered milk /g | Chicken | Pork liver /kg |
|---|---|---|---|---|---|---|
| M1 | 5 | — | 3 | 50 | 1/Tusday | 0.5/Monday |
| F1 | 7.5 | — | 3 | 50 | 1/Tusday | 0.5/Monday |
| F2 | — | 5 | 3 | 50 | 1/Tusday | 0.5/Monday |
| F3 | — | 6 | 3 | 50 | 1/Tusday | 0.5/Monday |

*Drinking behavior*

Drinking behavior is a kind of important instantaneous behavior. In the middle of cage, there is a trough for every Amur tiger. Sometimes Amur tiger drunk by standing around the trough, sometimes it drunk by prostrating itself. When it was hot or activity was frequency, there was a corresponding peak period for drinking.

*Urinating behavior*

Urinating was seen frequently after Amur tiger was let out from the interior cage every morning. During the other bouts of everyday, this behavior occurred randomly, and had not any rhythm at all. During the breeding seasons, Amur tiger often urinated towards the opposite sexes. This phenomenon was probably attributed to promoting the synchronic estrus or to marking the territory. Interestingly, M1 individual often urinated into the trough. This behavior is related to the habits during the young periods.

*Grooming behavior*

Amur tiger often scratch its hair by claws, lick its hair by tongue, rub the railing of cage, push the board in the cage, shake the skin and so on. Maybe Amur tiger was itched or had parasite. During the most time of observation, Amur tiger often rubbed the railing of cage. It was possible that Amur tiger can mark its territory by this way. When Amur tiger pushed the board, on the one hand, it may mark the territory similar to rubbing the railing, on the other hand, it may polish its claws. While rained, Amur tiger often shaked the skin in order to shake off the raindrop.

*Playing behavior*

Amur tiger sometimes jump, enjoy itself, roll or chase other objects etc. These behaviors were recorded as playing. Of 4 individuals, F1 had once been trained at the circus troupe of Harbin Zoo. Thus it was on friendly terms with people and was accustomed to Harbin Zoo. Especially when animal keeper came near the cage, F1 was sensitive to action of keeper, and often jumped up and down accompanying the keeper. In addition, F1 was also excited with visitors. When some visitors deliberately disturbed F1, it was also excited. In winter, F1 often rolled, this phenomenon was possibly related to rut seasons.

*Standing behavior*

Because the duration of standing was shorter, we thought of this behavior as a kind of instantaneous behaviors. However standing occurred frequently than other instantaneous behaviors. Standing was often found between moving and resting, it was possible because Amur tiger need the transformation of the two kinds of behaviors. When Amur tiger found something questionable or was disturbed by outside, it was standing immediately, and looking around to determine how to deal with. We thought this was a kind of reaction of warning and waiting.

*Standing straightly behavior*

When Amur tiger was in the internal cage, we often saw it stand straightly. Generally speaking, this kind of behavior occurred at night, in particular in winter. Since the period was Amur tiger's breeding season, this was probably a kind of estrus expression. Moreover, when somebody interfered Amur tiger in the outside, we can also see it stand erectly.

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